# Author's Accepted Manuscript

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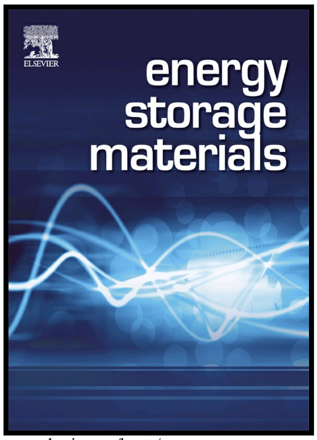


www.elsevier.com/locate/ensm

PII: S2405-8297(16)30117-9
DOI: http://dx.doi.org/10.1016/j.ensm.2016.05.008
Reference: ENSM64

To appear in: *Energy Storage Materials*

Received date: 27 April 2016
Revised date: 19 May 2016
Accepted date: 23 May 2016

Cite this article as: M. Sevilla, G.A. Ferrero and A.B. Fuertes, Graphene cellulose tissue composites for high power supercapacitors, *Energy Storag Materials,* http://dx.doi.org/10.1016/j.ensm.2016.05.008

# Graphene-cellulose tissue composites for high power supercapacitors

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**Abstract**

Flexible supercapacitors have aroused a great deal of interest for their integration in portable, flexible and wearable electronic devices. In this context, graphene has emerged as an excellent building block for the fabrication of flexible electrodes. However, free-standing graphene films suffer from a certain lack of mechanical resistance, which limits their use. In this paper, we report on the fabrication of free-standing and flexible composites with enhanced robustness, consisting of a graphene layer deposited over a porous cellulose tissue. The coated graphene consists of two types of holey graphene units (*i.e.* wrinkled graphene sheets and graphene nanoscrolls) that produce closely interconnected and porous 3D graphene architectures. The graphene-tissue composites developed here have a thickness of around 60 µm and areal densities in the 0.6-2.4 mg $cm^{-2}$ range. These composites have a very open structure that provides easy access to the electrolyte, thereby guaranteeing high ion-transport rates. In consequence, they show a remarkable capacitive performance in both liquid (1 M $H_2SO_4$) and solid (PVA-$H_2SO_4$) electrolytes. The supercapacitors assembled with these materials possess an areal capacitance of up to ~ 80 mF $cm^{-2}$ at low rates in both kinds of electrolyte and around 60 mF $cm^{-2}$ at 500 mA $cm^{-2}$ in $H_2SO_4$ and 54 mF $cm^{-2}$ at *ca.* 80 mA $cm^{-2}$ in a gel